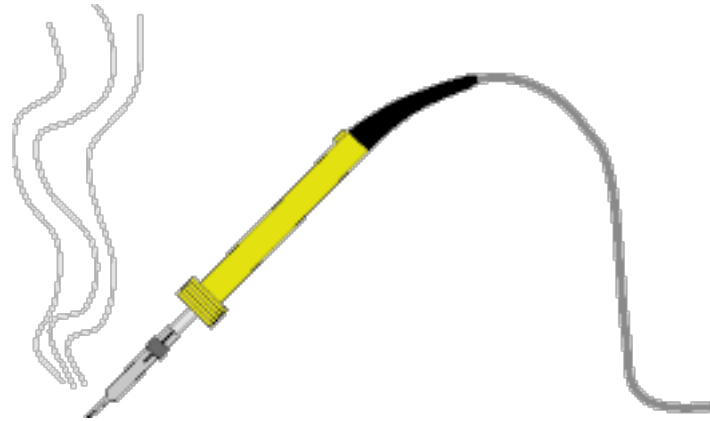


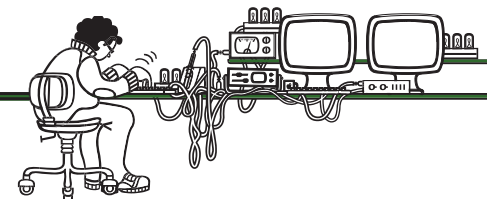
SOLDERING



BASIC ELECTRONICS – PART 1

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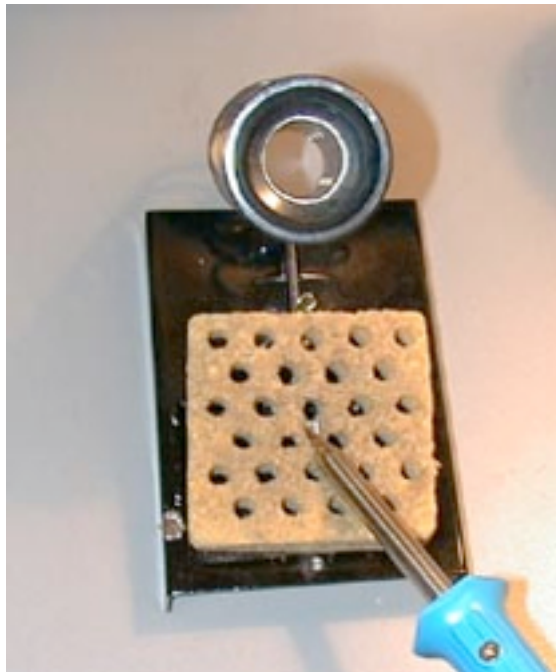
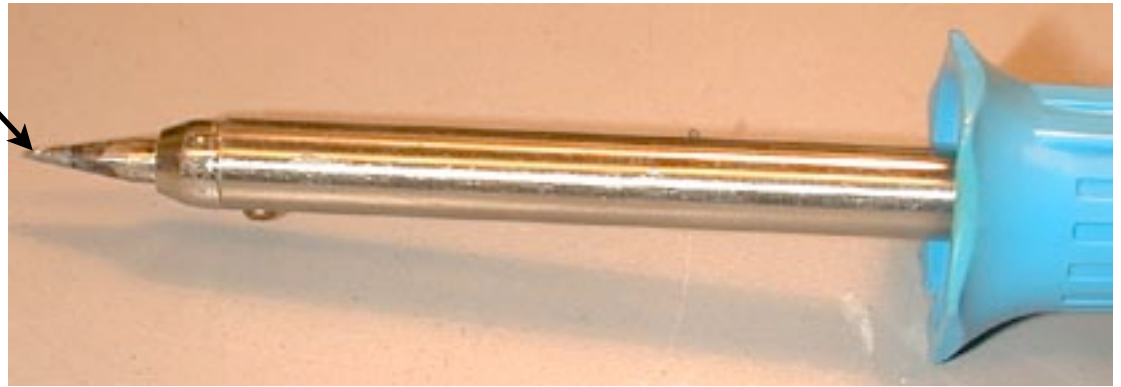
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The Iron

The soldering-iron has a **tip** which gets very hot ($\pm 350^{\circ}\text{C}$). Hot enough to melt tin and lead, but not other metals.

After plugging-in the iron, wait for it to get hot so the layer of solder which was left on the tip after the previous use(er) melts.



Wipe the tip clean on a damp sponge.

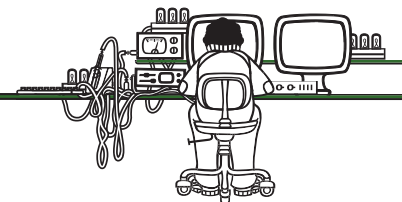
Ideally, a clean tip should look like this:



Whenever a hot iron is around, take very serious care not to touch the tip or the stem of the iron!! Likewise, take care that the iron doesn't touch any cables, plastic surfaces, limbs of colleagues, pets etc!!

If you do get a burn from an iron, **immediately** go hold it under cold running water for about 10 minutes (really!!)

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The Solder

This is a soft metal wire, usually an alloy (mixture of metals) of tin & lead. When exposed to the heat of the iron, the solder will melt and stick to any copper, bronze, messing, iron, nickel, zinc, gold or silver surfaces, **provided these surfaces are also hot enough** to melt the solder and **provided these surfaces are clean!!**

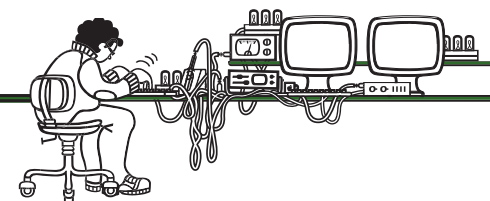
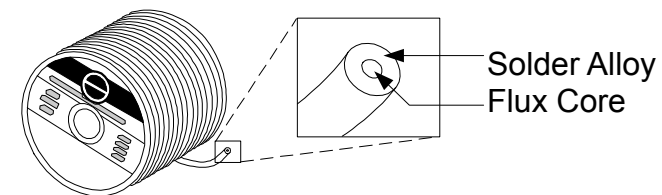
Most metals mentioned above (all except gold...) oxidize over time, with a thin layer of oxide forming on top of the metal surface. Such an oxide layer will prevent the solder from sticking, and must be removed before soldering.

Special solder exists for Electronics work, which comes with an inner core of 'Flux' or 'Rosin'. This flux inside the solder-wire melts just before the solder itself, and as the flux flows across the metal surface(s) to be soldered, it will etch away any **minor** oxidation before the molten solder comes flowing along.



Major oxidation you might see on old components, wires or circuit-boards should be carefully removed with steel-wool or fine sandpaper before soldering!

Always apply a little bit of solder at a time, and watch how it flows. Don't add more until you're positive it has flowed properly along all metal surfaces. If the solder doesn't flow correctly, wait a bit and allow the tip of the iron to heat-up the metal areas to be soldered.



Other Useful Tools for Soldering

Fine wire-cutters for snipping-off the excess wire of the components.

It is officially recommended to cut the excess wire **before** soldering, but you can get away with 'trimming the forest' after soldering, if you are careful!

This means; don't use excessive force and don't bend, break or tear the wire!! Just snip!



Tools for 'Undo'; Desoldering Tools

To remove a defective or wrongly mounted component, you'll have to desolder the component.

Desoldering Wick is a flux-covered copper-wire braid. When it is pressed onto a solder-joint with the tip of the iron, it will gradually absorb the solder from the joint into the wick. Cut off the used end of the wick before using it again.



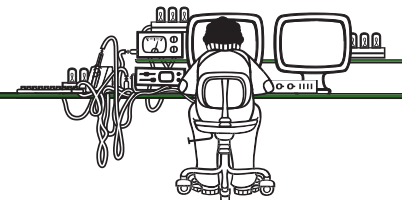
The Solder-Sucker is a spring-loaded suction pump with a heat-resistant tip. To use it;

1. press the plunger down to 'load' the sucker.
2. melt the solder-joint to be unsoldered with the tip of the iron.
3. hold the tip of the iron in place whilst also holding the tip of the sucker to the same solder-joint and press the button on the sucker.

Repeat if necessary, or use the Wick to remove the remaining solder.

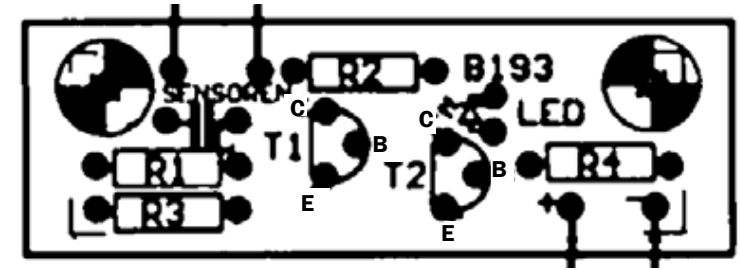


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Circuit-Board Assembly Tips

Carefully figure out which component goes where, and which way round! Study the provided schematic, board-diagram and the instructions for identifying the components.

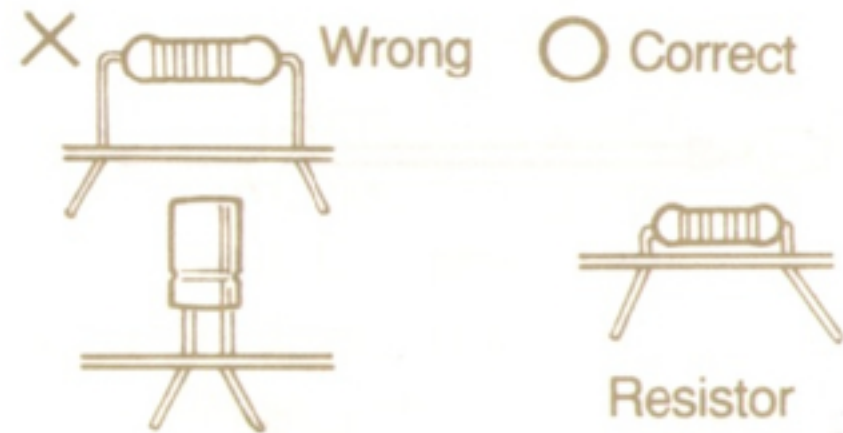


Place all components flush onto the board

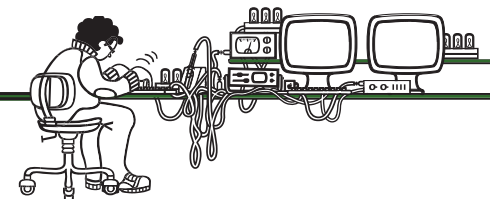
Start with the lowest-profile parts, and place the components on the board in batches of approximately equal-height parts. This is done so that after each batch, when you turn the board around to solder it, it will lie flat on the table, and any 'lower' components which might otherwise fall out will have been already soldered as part of an earlier batch.

Double-check all components' placement & orientation before soldering. Turning a component around is so much easier if it hasn't been soldered yet.

Correct way to install electronic parts.



Make sure you have enough light to work by. Most components are really small, and so are the solder-joints you'll be making. In poor lighting conditions it will be very difficult to see if the solder is flowing correctly.



The Art of Soldering

For Good Soldering™, three ingredients are essential:

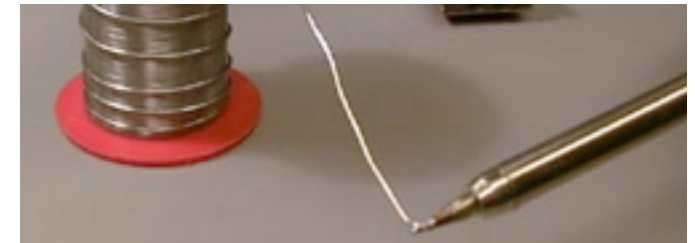
1. Patience
2. A steady hand & a good eye for detail
3. Experience

Step 1: Prepare the Iron

First clean the tip on a damp sponge.

Wet the tip by applying **a little bit** of solder directly to the tip. A little solder on the tip will improve thermal contact with the metal surfaces to be soldered, allowing the iron to quickly heat them up to the required temperature.

Too much solder on the tip will probably flow onto the solder-joint and 'blob' it! Wipe the tip on the sponge again & try again.

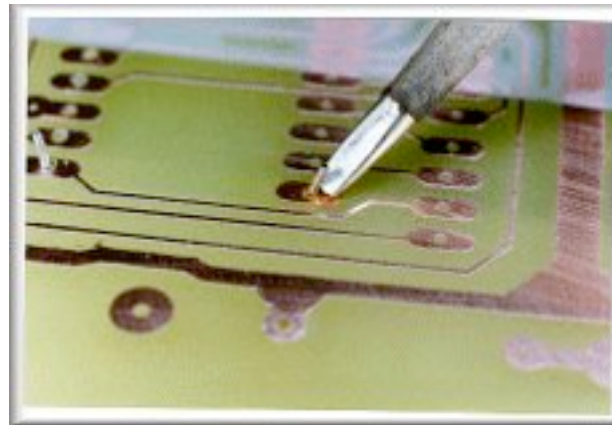


Step

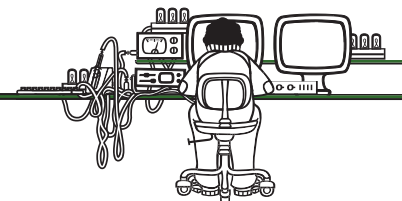
The solder will only flow and adhere on surfaces hot enough to melt it. Hold the tip to the surfaces so that it touches **both** the solder-pad and the wire sticking through the board.

Give it 2 to 3 seconds for things to heat up. Larger pads and/or thicker wires may need longer.

2: Preheat the surfaces to be soldered



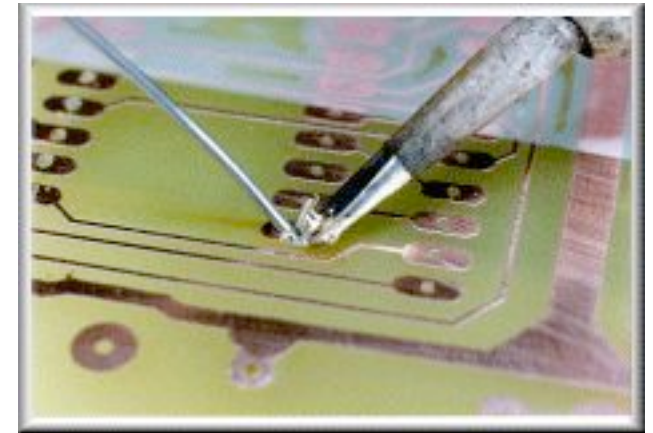
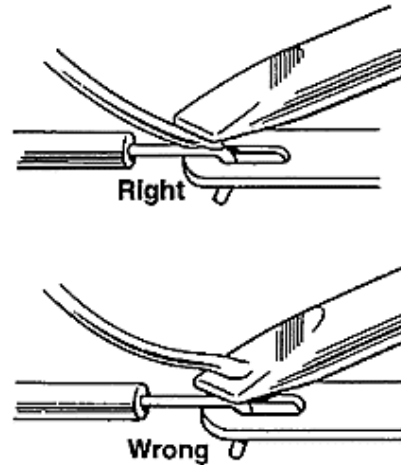
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Step 3: Apply Solder

Holding the iron in place, touch the solder-wire to the pad and the wire, **not** to the tip of the iron!

Solder applied directly to the tip will flow across the pad & wire eventually, but it will **not** adhere properly, because the flux will evaporate on the tip of the iron and never reach the surfaces to be soldered.

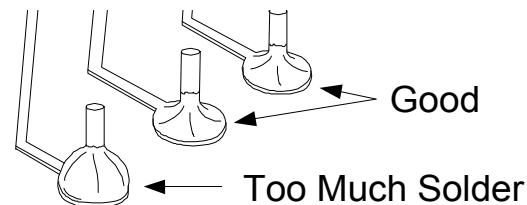
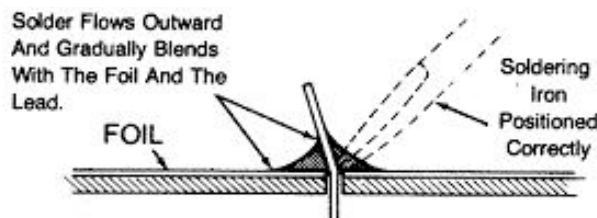
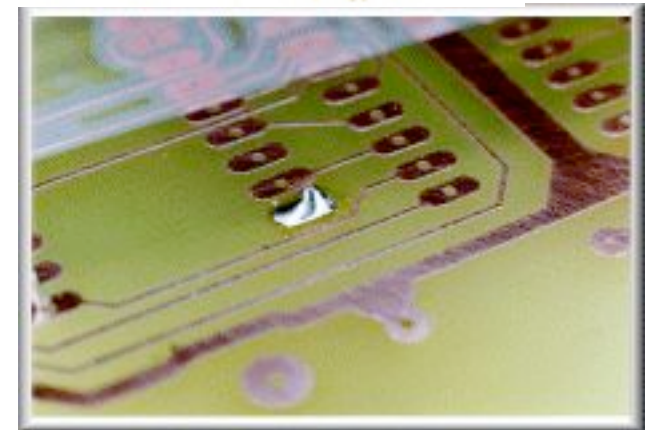


Allow 1 or 2 mm of the solder wire to melt and flow out across the metal surfaces. Hold the tip of the iron in place for 1-2 seconds for the solder to finish flowing, then withdraw the iron.

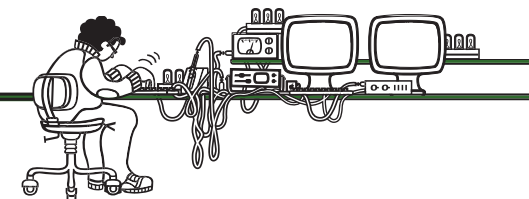
If the pad hasn't yet been completely covered by solder (like in the pictures below) repeat step 2 & 3 to apply more solder, always a little bit at a time.

When 'topping-up' a solder-joint, be sure to preheat it long enough for all of the solder already present to melt, so the extra solder you add next will flow **into** the existing 'puddle', and not over it!

More solder does not make a better connection! Take care not to 'blob' solder onto the solder-pad.



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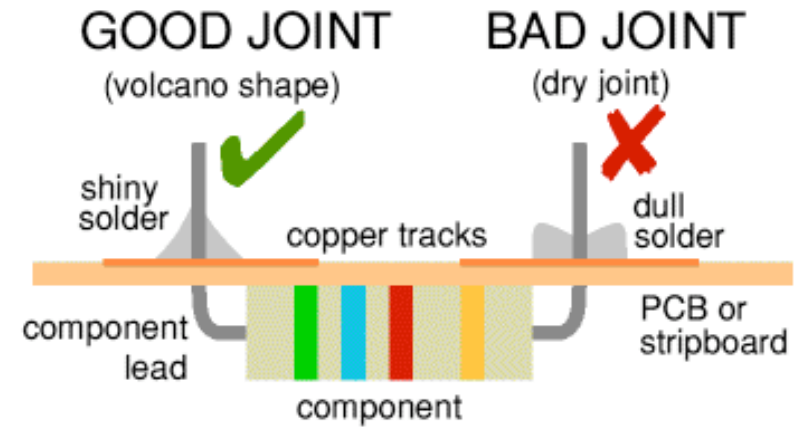
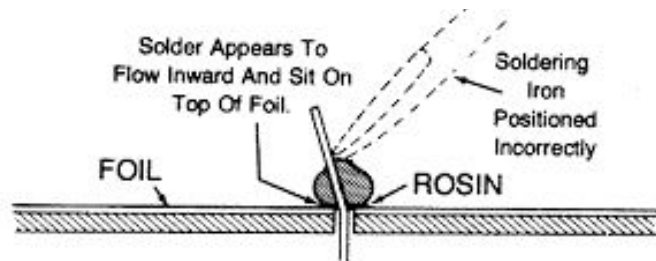
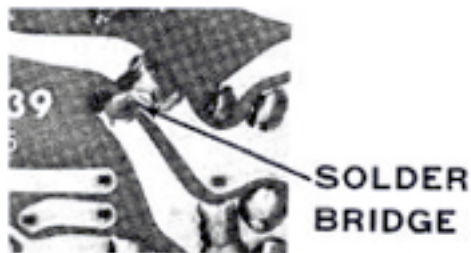
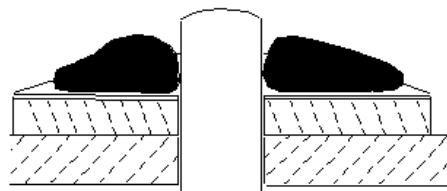
Step 4: Inspect Your Work

A good solder-joint looks like a shiny silver volcano, with the wire sticking out the top, instead of a crater or caldera.

If it isn't shiny, if it has any cracks or ripples, if it doesn't have a smooth curving 'slope' or if there's any dark or dull rings around the wire, it's not a good joint.

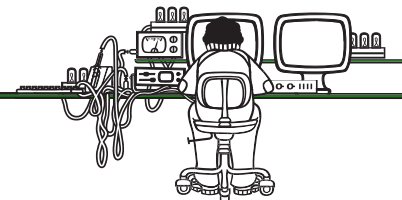
In most cases, re-melting it will do the trick, otherwise applying **the tiniest amount** of solder to the wire directly above the joint.

Some examples of Bad Joints:



Avoid accidental solder-bridges. These happen when (too much) solder from one pad 'blobs' across to a neighboring pad, creating an **unintended** connection.

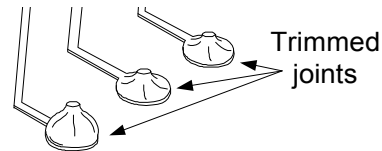
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Step 5: Trimming the Wires

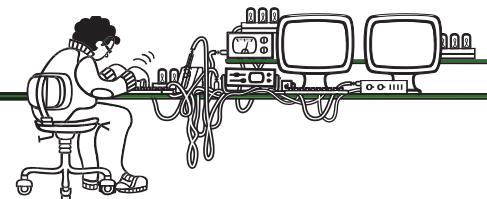
Any metal part touching another will create an (unwanted) electrical connection. To avoid this, we'll remove the excess wires sticking out.

Using the fine cutters, cut each wire just above the joint, being careful not to cut into the volcano-shaped solder-joint.



A clean, straight cut of the wire will require almost no force. If you feel you're squeezing quite hard and still not cutting, then either your cutters are very dull, or you're gripping the wire incorrectly.

Take care not to pull or wrench the wire with the cutters, because this could break the solder-joint, or, in the case of a very good joint, pull the entire solder-pad off the board!



This document is part of a Beginners Course in Basic Electronics.
download the other papers from:

http://www.mrstockinterfaces.com/groups/wiki/wiki/89c0b/Basic_Electronics.html

Stock, 2009

